Hexadimensional Cube Hypothesis

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1. Fundamental Postulate

There exists a 6-dimensional cube $\square \subset \mathbb{R}^6$ that contains within it a geometric structure defined by concentric spheres in a 3-dimensional subspace. This cube is not directly observable, but rather through orthogonal projections from each of its 6 faces. Each projection reveals a different visual pattern that depends on the face from which it is viewed.

2. Definition of the Base Cube

Let the unit cube in 6 dimensions be:

$$\square_0 = \{ (x_1, x_2, x_3, x_4, x_5, x_6) \in \mathbb{R}^6 \mid 0 \leq x_i \leq 1 \}$$

We define an internal radial sphere function in the coordinates (x_4, x_5, x_6):

$S(x_4, x_5, x_6) = \sqrt{[(x_4 - 0.5)^2 + (x_5 - 0.5)^2 + (x_6 - 0.5)^2]}$

This function measures the distance to the center of the internal 3D subcube.

3. The Six Observers and Their Views

Each observer O_j looks from the face $x_j = 0$ or $x_j = 1$, projecting the remaining 5 coordinates onto a 2D plane. The views are:

Observer 1 ($x_1 = 0$)

Sees nothing inside (opaque shadow):

$V_1(x_2, x_3, x_4)$ = total black

Observer 2 ($x_2 = 1$)

Sees a black sphere:

$V_2(x_1, x_3, x_5)$ = { black if $S(0.5, x_5, 0.5) \leq 0.3$; white otherwise }

Observer 3 ($x_3 = 0$)

Sees a large black sphere and a small white sphere above:

$V_3(x_1, x_2, x_4)$ = { black if $S(x_4, 0.5, 0.5) \leq 0.4$; white (point) if $(x_1-0.5)^2 + (x_2-0.8)^2 \leq 0.01$; white background otherwise }

Observer 4 ($x_4 = 1$)

Sees a ray of light tracing the contour of a sphere:

$V_4(x_1, x_2, x_3)$ = bright edge if $|S(x_1, x_2, x_3) - 0.5| < \varepsilon$

Observer 5 ($x_5 = 0$)

Sees an almost perfect sphere of diffuse light:

$V_5(x_1, x_2, x_6) = I_0 \cdot \exp(- (S(x_1, x_2, x_6) - 0.5)^2 / (2\sigma^2))$

Observer 6 ($x_6 = 1$)

Sees a perfect sphere (white inside, black outside):

$V_6(x_1, x_2, x_3) = \{$ white if $S(x_1, x_2, x_3) \leq 0.5$; black otherwise $\}$

4. Cube Hierarchy: Union and Scale

The cubes join to form a larger perfect cube. At each level k, space is tessellated with 2^{6k} cubes of size $1/2^k$:

$\square_k = \cup_\{m \in \{0,1,...,2^k-1\}^6\} (m/2^k + 1/2^k \cdot \square_0)$

An observer at level k scales with the cube: its projection plane contracts by 2^k, but its perceptual resolution (in units of the small cube) remains constant.

5. Recursive Perception

Let y be a point in the projection plane of observer j at level k. The view it perceives is:

$V_{k,j}(y) = f_obs^{(j)}(2^k \cdot (y - o_{k,j}))$

where $o_{k,j}$ is the origin of the cube containing y in the hierarchy, and $f_obs^{(j)}$ is the view function defined for the unit cube (Observers 1 to 6).

Union of neighboring views: When two adjacent cubes join, their views combine by juxtaposition:

$$\Omega_k(y) = \oplus_{\{\text{neighboring cubes}\}} V_{k,j}(y)$$

where $\oplus$ is a composition that respects edges (continuous stitching).

6. The Human Limit

Humans are macroscopic observers: our level k is very large. We see a massive cube composed of innumerable small cubes:

$$\Omega_{human}(y) = \lim_{k\to\infty} \Omega_k(y)$$

This limit converges to an emergent pattern $\Omega(y)$ that can be fractal, periodic, or quasiperiodic, depending on how the 6 basic observers concatenate along the hierarchy.

7. General Recursive Equation

Let Ω be the translation and scale operator. The complete hierarchy is summarized as:

$$\Omega(k, j, y) = \Omega[\ \Omega(k-1, j, 2(y - o))\ ] \oplus f_{obs}^{(j)}(2^k\ (y - o))$$

with the initial condition $\Omega(0, j, y) = f_{obs}^{(j)}(y)$.

8. Consequences of the Hypothesis

1. Multiperspectivism: The same object (the 6D cube) manifests as 6 different visual realities depending on the observation face.

2. Self-similarity: The structure repeats at all scales; each cube contains reduced copies of itself.

3. Emergence: The human observer, being very large, does not see individual cubes but a collective pattern integrating infinite contributions.

4. Light-darkness unification: Black spheres, white spheres, and rays of light are different projections of the same internal 6D geometry.

9. Final Symbolic Representation

$$\mathbb{H}_cube = \{ \square_k, \{V_{k,j}\}_{j=1}^{6}, \oplus, \square, \lim_\{k\to\infty\} \}$$

where $\mathbb{H}_cube$ is the entire hierarchical system of perception of the hexadimensional cube.

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10. Time: Cube Unions and the Vertical Line

In the hierarchy □ₖ, we define the vertical axis as the direction of growth of k (scale depth).

Time emerges when an observer travels vertically through the hierarchy, crossing unions between cubes of different levels.

- · A vertical union occurs when a cube at level k connects with another cube at level k+1 through a shared scaled face.
- · Each vertical union implies a quantum leap of perception: the image changes according to □.

Postulate of time:

Time is a perceived coordinate $t \sim k \cdot \Delta t_0$, with Δt_0 inversely proportional to the observer's resolution.

Ascending in k (smaller → larger), one advances toward the macroscopic future.

Quantum gas as the origin of time:

In the limit $k \to -\infty$ (Planck scale or pre-geometric), the 6D cube becomes a structureless quantum gas:

- · Coordinates $(x_1,\ldots,x_6)$ undefined (uncertainty principle in 6D).
- · The projections $V_{k,j}$ are random wave functions.
- · Vertical unions are decoherence events that fix a temporal direction.

11. Space: Cube Unions and the Horizontal Line

Space emerges from horizontal unions between cubes of the same level k.

We define three effective spatial axes from the 6 projections:

- · Observers 1 and 2 → X axis (mix of x_2,x_3)
- · Observers 3 and 4 → Y axis (mix of x_1,x_4)
- · Observers 5 and 6 → Z axis (mix of x_5,x_6)

Each horizontal union is a juxtaposition ⊕ that glues two neighboring views. This generates a spatial metric:

$ds^2 = \Sigma_{a=1}^3 h_a(k) \cdot (d\xi_a)^2$

where ξ_a are emergent coordinates and h_a(k) are scale factors.

At the human level (k → ∞), h_a(k) tends to a constant → local flat space.

12. Gravity and Spacetime Intersection Curvature

Gravity = variation of the vertical union with horizontal position

Let □_V(x,y,z) be the density of vertical unions per unit of horizontal volume.

When □_V is high, local time runs slower.

Curvature is defined as:

$R_{\mu\nu} = \partial_\mu \partial_\nu \log \square_V$

In terms of the cube:

- · The intersection between a vertical line (time) and a horizontal plane (space) is an observation point in the 6D cube.

- · Curvature appears when the projections $V_{k,j}$ change differentially when moving horizontally and vertically (non-commutativity).

This is analogous to a non-holonomic connection in $\mathbb{R}^6$ projected:

[∇{space}, ∇{time}] ≠ 0 ⇔ curvature ≠ 0

13. Light as Midpoint and Final Super Crystalline Structure

13.1 Light as Midpoint

Light appears at level k_L where:

1 / 2^{k_L} ~ emergent wavelength

and for those observers j whose projection contains bright contours (V_4) or Gaussian spheres (V_5).

Midpoint:

Between the quantum gas (k → -∞) and the supercrystal (k → ∞), there exists a range of k where:

- · Black/white spheres coexist in complementary relationship (like interference).
- · The function $V_{k,j}$ oscillates between "opaque shadow" and "perfect sphere".

That range is perceived as observable light by a human.

13.2 Final Super Crystalline Structure

At $k \to \infty$:

- · The operator □ leads to an attractor in the space of views.
- · The six views $f_{obs}^{(j)}$ renormalize to six perfect periodic projections.
- · The emergent spacetime becomes a super crystal:

$$□_{\infty, j}(y) = \Sigma_{n \in \mathbb{Z}^3} A_j \cdot e^{i G_n \cdot y}$$

with G_n reciprocal FCC lattice (face-centered cubic).

Properties of the supercrystal:

1. Rigid causality: zero gravity, uniform time.

2. Residual gauge symmetry: discrete translations on the lattice.

3. Light travels without dispersion (exact linear dispersion relation).

The initial quantum gas and the final supercrystal are connected by a geometric phase transition mediated by light at the midpoint.

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14. Summary of Emergent Equations

(1) Vertical time:

$t_k = \Sigma_{n=-\infty}^{k} \Delta t_0 \cdot 2^{-n/2}$ (logarithmic scaling)

(2) Curvature:

$K(x, t) = (\partial/\partial t) (\nabla^2_x \log \square_V(x, t))$

(3) Light as midpoint:

$k_{light} = \frac{1}{2} (k_{quantum\ gas} + k_{supercrystal})$ with $k_{gas} \to -\infty$, $k_{supercrystal} \to \infty$

(4) Final supercrystal:

$\square_{\infty, j}(y) = \Sigma_{n \in \mathbb{Z}^3} A_j \cdot e^{i G_n \cdot y}$

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15. System Closure

$\mathbb{H}_{cube} = \{ \square_k, \{V_{k,j}\}_{j=1}^{6}, \oplus, \square, \lim_{k\to\infty}$, vertical time, horizontal space, curvature, light as midpoint, final supercrystal $\}$

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"The cube is not seen; it is inhabited from its six faces. Time is the vertical scar of scale. Curvature is the echo of an imperfect union."

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